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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of:	)	
	)	
Federal-State Joint Board on Universal Service	)	CC Docket No. 96-45
	)	
Forward-Looking Mechanism for High Cost Support for Non-Rural LECs	)	CC Docket No. 97-160

COMMENTS OF GTE SERVICE CORPORATION

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September 2, 1997

Redacted Version

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SUMMARY

As GTE has consistently stated, the most accurate way to allocate universal service funding is through carrier-specific, state-approved cost models until a competitive bidding mechanism can be adopted. Use of competitive bidding to provide universal service would fulfill the Telecommunications Act of 1996's requirement that funding be sufficient, while ensuring that service is provided at the lowest possible price. In addition, use of such a mechanism would encourage competition in the local exchange market, another goal of the Act.

However, if the Commission determines that a cost proxy model should be used to allocate universal service support, GTE has several recommendations which will improve the accuracy and reliability of the results of any cost proxy model. In response to the Commission's questions on the size of the geographic area over which costs should be calculated, GTE believes that grid cells are the most appropriate size unit. The size of the grid cells should be 1/100th of a degree by 1/100th of a degree. Information on grid cells is easily derived from forecasted Census data, which GTE has confirmed through use of grid cells in its own cost model.

The Commission also asks how the customer distribution algorithms of cost proxy models can be improved. Because distribution facilities are such a significant portion of universal service costs, it is critical that any cost proxy model account for customer location accurately. In particular, GTE is concerned that the Hatfield Model produces severely low cost estimates of the distribution facilities necessary to serve customers.

A combined approach of using actual wire center and mapping data, as well as a more accurate grid, will provide improved estimates of customer location. First, using existing ILEC wire centers to assign grid cells ensures that real-world conditions, such as freeways, rivers, lakes, and hills, are taken into account and that the number of wire centers accounted for in the model is sufficient to serve each area. Second, although geo-coding of all households on a national scale is impractical, geo-coding can be used on a random sample of locations within a grid cell and extrapolated to larger areas. Third, commercial mapping software can be used in a cost proxy model to take into account both geographic factors, such as rivers and freeways, and other real-world conditions, such clustering of customers on boundaries of Census blocks.

In the FNPRM, the Commission seeks comment on methods that could be used to improve line count algorithms in the Hatfield and BCPM Models. Rather than improve algorithms, GTE recommends that the Commission use actual ILEC wire center line count information. The Commission has recently collected this information through its universal service data request. Although these line counts must be treated as confidential, they could be used by the universal service fund administrator to calculate support flows.

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COMMENTS OF GTE SERVICE CORPORATION

GTE Service Corporation and its affiliated domestic telephone operating companies (collectively "GTE")[1] respectfully submit their Comments on the Further Notice of Proposed Rulemaking ("FNPRM") in the above-captioned proceedings.[2] GTE continues to believe, as it has explained in its prior pleadings in this docket, that a cost proxy model should not be used to determine the costs associated with providing universal service. Such a model will, by definition, only estimate costs, not reliably account for all expenses incurred by the incumbent local exchange carriers ("ILECs") responsible for providing universal service. Therefore, use of such models will not

[1] GTE Alaska, Incorporated, GTE Arkansas Incorporated, GTE California Incorporated, GTE Florida Incorporated, GTE Hawaiian Telephone Company Incorporated, The Micronesian Telecommunications Corporation, GTE Midwest Incorporated, GTE North Incorporated, GTE Northwest Incorporated, GTE South Incorporated, GTE Southwest Incorporated, Contel of Minnesota, Inc., and Contel of the South, Inc.

[2] FCC 97-256 (rel. July 18, 1997).

ensure that ILECs receive sufficient funding to cover the costs of providing universal service, as required by the 1996 Telecommunications Act.[3]

Prior to the Act, both this Commission and the states funded universal service through hidden subsidies which kept local residential, and some single line business, telephone rates artificially lower than costs by pricing other services above their relative costs. Nonetheless, through a combination of interstate and intrastate rates, carriers were given a reasonable opportunity to recover all of their actual costs. In contrast, hypothetical cost proxy models do not ensure full recovery of the costs of providing universal service. Until telephone rates are rebalanced so that they are based on the costs of providing service, the use of a cost proxy model will only exacerbate the problem of ensuring that universal service goals are fulfilled.

Because of the inherent shortcomings of generic cost proxy models based on hypothetical engineering and other cost factors, GTE urges the Commission to use carrier-specific, state-approved engineering models to allocate universal service funding until a competitive-bidding mechanism can be adopted. However, if despite the many problems identified, the Commission does consider a cost proxy model, GTE has several recommendations which would increase the accuracy of such a model's cost estimates, and, in particular, provide more reliable results than those produced by the Hatfield Model.[4]

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[3] 47 U.S.C. § 254(b)(5).

[4] As in its previous filings, GTE declines to comment in detail on the new BCPM Model since it has not yet been made available. GTE will provide a detailed analysis of that Model when GTE has the opportunity to examine it.

I. INTRODUCTION

In the second phase of this proceeding, the Commission has requested comment on the best methods of determining customer location in a cost proxy model. Accurate determination of customer location is critical to developing reliable cost estimates because a significant portion of the costs of providing universal service stems from the distribution facilities needed to reach customers. Particularly for high cost areas, the expenses incurred providing service are dominated by the costs of building loops to widely dispersed households and businesses.

The Commission has focused in particular on the geographic unit over which support costs should be estimated, the distribution of customers throughout that geographic unit, and access line counts. As explained below, by incorporating more real-world data into a cost proxy model, the results derived from that model will correspondingly reflect more realistic cost estimates. First, the Commission should use the smallest geographic unit for which a distribution network can be developed for its cost calculations, which is a grid cell. Grid cell level information is easily derived from forecasted Census data and allows more individual area characteristics to be taken into account. Second, incorporating existing wire centers and mapping software into the cost proxy model will improve the model's ability to predict customer distribution. Third, using actual ILEC wire center line counts will ensure that accurate estimates are produced at the grid cell level without use of a closing factor. Incorporating these requirements into a cost model will help reduce the inaccuracies that have been identified in both the Hatfield and BCPM Models.

II. USING GRID CELLS WILL PRODUCE MORE ACCURATE COST ESTIMATES THAN THE USE OF CENSUS BLOCK GROUPS ("CBGS"). (Section III.C.1.a)

In the FNPRM, the Commission requested comment on whether universal service cost calculations should be based on a geographic area smaller than a CBG, such as a Census block ("CB") or grid cell, and whether use of a smaller area would increase the accuracy of cost calculations.[5] Grid cells are the best geographic unit for determining the costs of providing universal service. The grid cell level is the smallest geographic unit for which a distribution network can be developed and, therefore, produces the most accurate cost estimates. Grid cells of 1/100th of a degree by 1/100th of a degree are similarly shaped and produce an easy overlay for forecasted CB data. GTE's own Integrated Cost Model uses grid cells as its basic geographic unit for cost calculation. This Model combines CB data with GTE proprietary information to render an exceptionally accurate picture of each grid cell.[6] Forecasted Census block data is publicly available and can easily be broken down to the grid cell level. Thus, any proxy model adopted should make use of grid cells.[7]

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[5] FNPRM, ¶ 40.

[6] Such accuracy provides further support for the Commission to use carrier-specific cost models rather than a generic industry proxy model.

[7] Although costs for determining universal service funding support should be calculated at the grid cell level, universal service funding should be distributed on a CBG basis by combining grid cells within the CBG. Distributing funding based on a grid cell level would be administratively burdensome and create unnecessary costs.

Although data for grid cells are easily obtainable and produce more accurate results, the Hatfield Model continues to use CBGs, which vary significantly in size, as a geographic platform to estimate distribution facilities. Since distribution accounts for a significant proportion of the Hatfield Model's total distribution plant costs, accurate distribution estimates are essential. Although the Model's supporters have stated that CBGs are intended to approximate local serving areas (200 to 600 households),[8] CBGs often contain either fewer than 200 households or more than 600 households and thus fail to provide the accurate picture of serving areas that is necessary to support a reliable cost estimate. Although the Hatfield Model would still not produce accurate cost estimates because of its other widespread problems and omissions, use of grid cells rather than CBGs would improve its estimates.

III. COMBINED USE OF ACTUAL DATA AND A MORE ACCURATE GRID WILL PROVIDE BETTER ESTIMATES OF CUSTOMER DISTRIBUTION THAN WILL EXISTING MODELS. (Section III.C.1.b)

Although a cost proxy model can never incorporate the number of factors necessary to produce results as accurate as a carrier-specific model, the Commission can make several improvements to reduce the serious flaws of the proposed models. First, the Commission should assign households to existing ILEC wire centers by using data obtained in the recent universal service data request. Second, the Commission should geo-code random samples of locations and extrapolate the results of larger

[8] Workshop Before the Washington Utilities and Transportation Commission, Docket UT-960369, UT-960370, and UT-960371 at 158-159 (Feb. 14, 1997). The cited pages are attached as Exhibit 1.

areas, such a grid cells. Third, the combined use of commercially available mapping software and forecasted Census data will significantly improve a model's ability to predict accurately the location of customers.

A. The Hatfield Model does not provide an accurate estimate of customer distribution.

Although the Hatfield Model's customer distribution methodology has been changed significantly since it was first fabricated, it still does not accurately account for the distribution of customers in ILEC local serving areas and therefore seriously miscalculates the distribution plant necessary to serve customers.[9] To determine the distribution of customers, the Hatfield Model represents each CBG as a square divided into four quadrants.[10] The Model then adjusts the total square area by a certain percentage, called an "empty fraction," which supposedly represents the area of the CBG classified as empty. Based on the size of this empty fraction and the number of customer locations in the CBG, the Model then creates "clusters" of customers in the quadrants. An example of such a squared CBG is shown in Figure 1, below.

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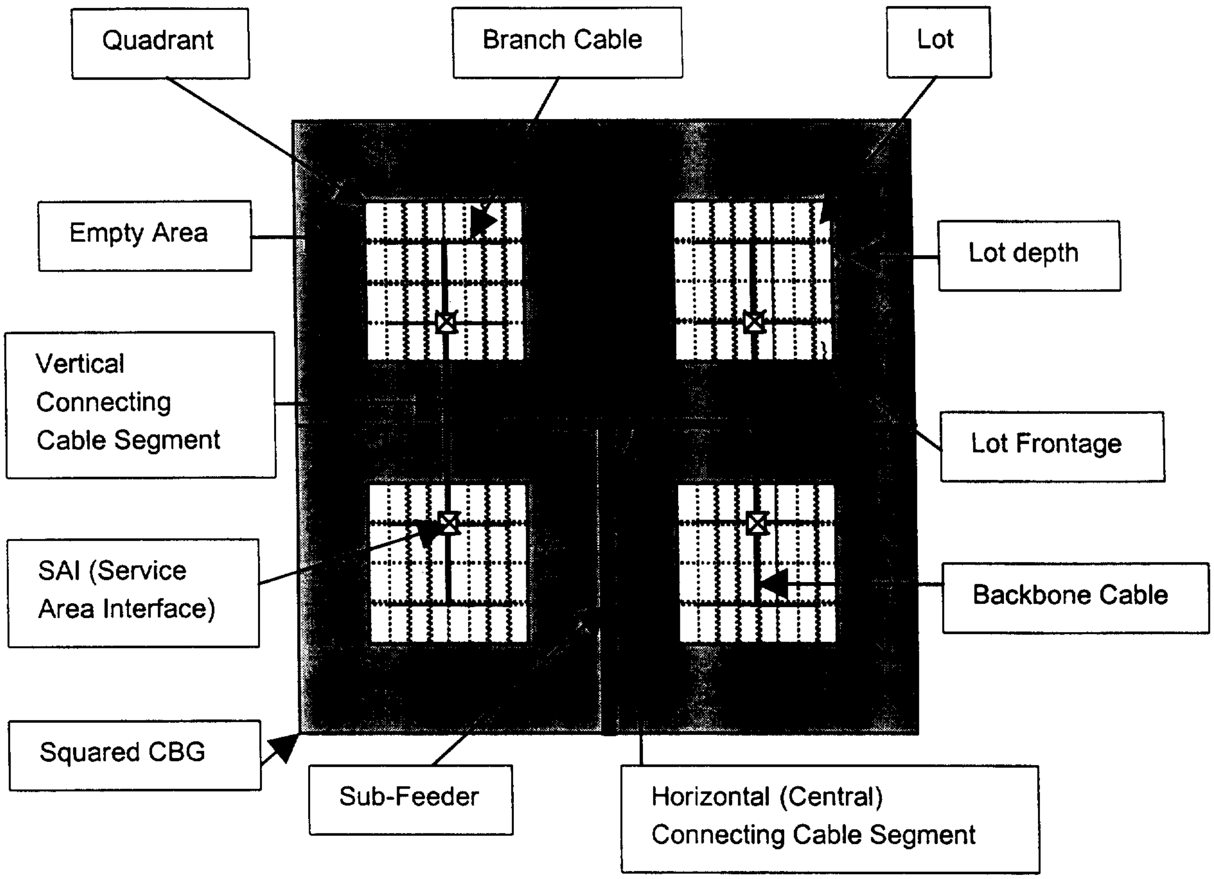
[9] This analysis is based on Hatfield Model 3.1. GTE is in the process of examining the most recent release of Hatfield Model 4.0, which was only made publicly available withint the last three weeks.

[10] The methodology employed by the Hatfield Model is explained in further detail in Exhibit 2.

Figure 1
Hatfield Model, Release 3.1
Distribution Plant Architecture



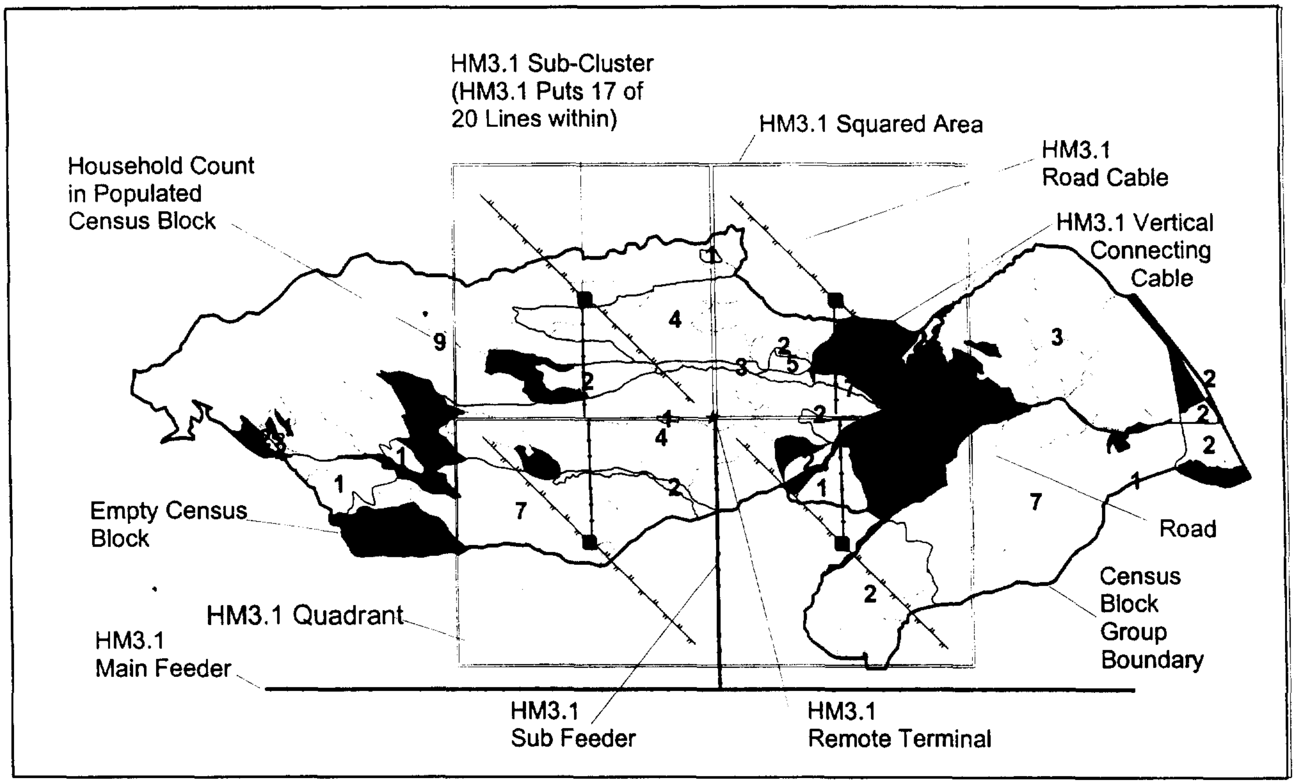
This method of determining customer location is too simplistic to produce an accurate picture of actual customer distribution. By assuming that the households in a CBG are grouped into clusters, the Model may significantly underestimate the ILEC's distribution plant needs which are a large part of universal service costs.

A detailed examination of the Hatfield Model's estimated feeder and distribution network for Colorado CBG 80719832003 demonstrates these shortcomings, as shown below in Figure 2. This CBG, shown by the irregular boundary, has an area of 143 miles and contains 80 switched access lines. Based on the information used by the

Hatfield Model, 16 percent of this CBG is considered empty. The distribution algorithm therefore superimposes a square on the CBG, divides the square into four quadrants, and reduces these four quadrants equally to reflect the 16 percent of the CBG classified as empty.

Because of this CBG's density ratio, the Model assumes that 85 percent of the switched access lines are clustered in four small black boxes, one in the middle of each quadrant. It also assumes that the remaining 15 percent of access lines not located in these clusters are served by the road cable represented by the notched lines extending from each cluster. In contrast, the actual household count and distribution in each populated Census block is illustrated in bold numbers scattered throughout the irregular boundaries of the CBG.

Figure 2
Visual Illustration of Hatfield's Resulting Feeder and Distribution Network
Colorado CBG 080719832003



The actual access line numbers show that the Hatfield Model does not come close to estimating the necessary distribution facilities to serve the customers of this CBG. For example, although the Model assumes that 85 percent of the population is gathered in four clusters, the actual distribution numbers show that customers are spread throughout the CBG rather than clustered in groups. GTE is currently applying the Hatfield Model distribution mechanism to GTE service areas and expects that the results will show inaccuracies similar to those above.

B. For accurate distribution calculations, households must be assigned to ILECs' actual serving wire centers.

In the FNPRM, the Commission seeks comment on how to improve both the Hatfield and BCPM Models' accuracy in assigning CBGs or other geographic units to serving wire centers.[11] The best and easiest way to ensure accuracy is to use current ILEC wire centers. This information was recently submitted to the Commission in response to its universal service data request.[12] Although these wire center data are confidential and cannot be released publicly for competitive reasons, the information could be used as an input to a cost proxy model by the universal service fund administrator to calculate support flows.

In contrast to using existing wire centers, the Hatfield Model often assigns households within a CBG to the wrong wire center. For example, for GTE service areas in Washington State, the Hatfield Model omits six wire centers out of 105. Of the wire centers the Model accounts for, 70 contain line estimates that are inaccurate by more than 10 percent of the actual line count.[13] These inaccuracies most likely result from the fact that the Hatfield Model fails to incorporate real-world conditions, such as freeways, rivers, lakes, and hills that may prevent a household from connecting to the

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[11] FNPRM, ¶ 44.

[12] Order, CC Docket No. 96-45 ¶ 7 (rel. July 8, 1997) (requesting that ILECs provide information on loop counts per wire center).

[13] The analysis is attached hereto as Exhibit 3. A preliminary review of Hatfield Model 4.0 shows no real improvement of these results.

closest wire center. Using actual customer assignment data for each wire center will eliminate this problem.

C. Geo-coding is impractical on a national scale but could be used for samples of small areas.

The Commission requests comment on the "availability, feasibility, and reliability of software that will geo-code households."[14] Using forecasted Census data and currently available software programs, it is possible to assign coordinates to almost any address in the United States. The geo-coding process uses mapping software to assign correctly 70 to 90 percent of a list of addresses without additional information. Errors are due to imprecision in the data, such as missing distinctions between similar street names, duplicate street names, streets with multiple names, and misspellings. Many of these problems can be addressed manually, resulting in accurate geo-coding of between 85 and 95 percent of all households, a much more accurate distribution mechanism than the Hatfield Model.

Unfortunately, geo-coding all households is impractical on a national scale because of the significant time and computing resources that would be required. However, the Commission may be able to incorporate geo-coding into a cost proxy model through random location samples. For example, a cost proxy model could use commercially available software to geo-code a random sample of locations in a serving area and extrapolate this information to a larger area, such a group of grid cells or a

[14] FNPRM, ¶ 44.

Census block. This would allow inclusion of some of the benefits of geo-coding without the difficulties of working with an impractically large numbers of households.

D. Commercial mapping software will improve the accuracy of any cost proxy model.

Although geo-coding all households is not feasible on a national scale, the use of mapping software would greatly improve a cost proxy model's accuracy in identifying the location of customers within a service territory by incorporating geographic features. The numbers of households in a set of CBs can be used in combination with the center and/or vertex coordinates of the CBs for modeling average distances between customer locations and wire center locations. These software products can apportion CB household counts into both grid cells and wire center serving areas.[15]

Such calculations could also be performed at the street segment level. Street segment data provides a higher degree of precision than CB data and recognizes more real-world conditions, such as clustering of customers on boundaries of CBs. In addition, combining such forecasted Census data and mapping software allows for accurate determinations of the location of any areas covered by water. There are also low-cost software packages that generate point-to-point driving routes which could be

[15] A uniform distribution of customers must be assumed in order to avoid the time and computing constraints of geo-coding all households on a national basis. However, as long as small geographic units are used, such as grid cells, a uniform distribution assumption does not lead to significant inaccuracies. If a uniform distribution assumption is made for a larger area, such as a CBG, then the use of mapping software can lead to unreliable results. The Hatfield Model's use of CBGs as its basic cost calculation unit is an additional reason why this Model is incompatible with the use of mapping software.

used to determine the location of geographic boundaries, such as rivers or highways. A list of the currently available commercial mapping software and services which GTE believes would be most helpful are included in Exhibit 4, attached hereto.

Not surprisingly, the use of mapping software is incompatible with the Hatfield Model because mapping software takes actual customer location into account. This would conflict with the Hatfield Model's basic approach of artificially moving blocks of customers into four quadrants within CBGs. It is unlikely that the Hatfield Model could be modified to incorporate the use of mapping software because such a change would require that most of the Model's code be rewritten. Because the BCPM Model evenly distributes customers across the entire CBG (not including empty areas) and recognizes that customers are not clustered into quadrants, it could be more easily modified to include with the use of mapping software.

IV. THE COMMISSION SHOULD USE ACTUAL WIRE CENTER COUNTS. (Section III.C.1.c)

In the FNPRM, the Commission seeks comment on what methods can improve the line count algorithms in the Hatfield and BCPM Models and whether a closing factor, or adjustment factor, of 10 percent between the lines predicted by the model and the actual line count should be adopted.[16] The most accurate method for determining line counts is to use actual ILEC wire center line count information. As explained above, detailed wire center information was recently submitted to the Commission in response to its universal service data request and can be used by the universal service

[16] FNPRM, ¶ 53.

fund administrator, subject to confidentiality restrictions, to compute the necessary fund distributions.

The Commission states that "reasonable estimates of the number of lines in each CBG, CB, or grid cell are necessary to calculate universal service support."[17] GTE agrees. The forecasted Census data and mapping software mechanisms outlined above are critical to allocating wire center line counts to either CBGs, CBs, or grid cells.[18] Using actual wire center counts also has the advantage of eliminating the need for a closing factor because the line counts will be 100 percent accurate at the wire center level.

GTE's own examination of the Hatfield Model's line count estimates confirms the Commission's conclusion that the Hatfield Model's algorithm does not accurately predict line count.[19] GTE has found that for its service areas more than 50 percent of the Hatfield Model's wire center calculations deviate by greater than 10 percent from actual wire center count. Because the Hatfield Model uses CBGs as its basic geographic unit, use of actual wire center counts will not significantly improve the Model's accuracy. Without the use of mapping software, which is incompatible with the Hatfield Model, it is almost impossible to allocate accurately wire center line counts to CBGs.

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[17] FNPRM, ¶ 53.

[18] GTE uses a similar approach in its own Integrated Cost Model.

[19] FNPRM, ¶ 53.

V. CONCLUSION

Carrier-specific, state-approved engineering models will provide accurate forward-looking cost calculations with none of the difficulty of developing algorithms to estimate these costs. Use of such models would fulfill the Act's requirement of sufficient universal service funding until a competitive bidding mechanism which uses market forces to allocate funds can be established. Cost proxy models will fail both to ensure sufficient funding and to provide competitive efficiency incentives.

If despite these problems, the Commission still chooses to use a cost proxy model to allocate universal service funding, GTE urges the adoption of its recommendations to improve the accuracy of such a model for the foregoing reasons.

Respectfully submitted,

GTE SERVICE CORPORATION and its affiliated domestic telephone operating and wireless companies

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September 2, 1997

EXHIBIT 1

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

In the Matter of the Pricing Proceeding for Interconnection, Unbundled Elements, Transport and Termination, and Resale	)	DOCKET NO. UT-960369
In the Matter of the Pricing Proceeding for Interconnection, Unbundled Elements, Transport and Termination, and Resale for U S WEST COMMUNICATIONS, INC.	)	DOCKET NO. UT-960370
In the Matter of the Pricing Proceeding for Interconnection, Unbundled Elements, Transport and Termination, and Resale for GTE NORTHWEST INCORPORATED	)	DOCKET NO. UT-960371

A workshop in the above matter was held at 9:15 a.m. on February 14, 1997, at 1300 South Evergreen Park Drive Southwest, Olympia, Washington.

Cheryl Macdonald, CSR
Court Reporter

background goes from splicing wires and fibers together all the way up through and including doing methods and procedures for one of the RBOCs.

I guess in one of the western states the question was asked in my absence whether I was fired by NYNEX and the answer is no, I took an early retirement package and they were sorry to see me go, so I was not persona nongrata. But you will see one or more members of the engineering team in this venue in the future, Dean Fassett, who those of us who consider him a close friend refer to him as the dean of rural design because Dean comes from the Adirondack Mountains of upstate New York, and I know Dean very, very well and he's especially attune to the territory in the support of the country. He's currently testifying in Montana so he could not be here.

MS. PROCTOR: Wyoming. Montana was earlier in the week.

MR. DONOVAN: He's kind of on the tour. So I was available to come out here, and I am very pleased to do it. I'm going to run very quickly through some basic slides and then get into the meat of it and then get into the questions because I think that's where it's most interesting, but I am reminded of Vince Lombardi who in his professional coaching career used to start every spring training with the talk that, Gentlemen, this is a football.

So just touching base on the basic diagrams which you should have in your diagram, this is what I do. I don't do the switch but I do do the loop. I think I attended probably AT&T's first course back when it was one Bell system on long-range outside plant planning, and just in a couple of slides I want to give you a flavor as to what's come in between both BCPM and this model, and also to reflect on the fact that although we can continue to refine this, and engineers like myself, all engineers are prone to continue improving whatever it is we do ad nauseum sometimes, that we are trying to create an economic model or an econometric model and not to create a computerized engineering function that will displace all the outside plant engineers in the industry. Yet sometimes we feel like we want to get down to that level of detail.

But the way the Bell system back -- I went to this course in 1976 and so some of it is still valid. In an attempt to model the network, took a distribution area of 200 to 600 living units and created an entity and then connected that through what we called at that time EFRAP sections, which was

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exchange feeder route analysis program, and moved that aggregation back towards the CO, which is identical to what we're trying to do in this model, and obviously we continue to build it up until you have all of them, and all of them go one into the other, what in New York we used to refer as the goes-into file, 2204 goes-into 2203.

And lo and behold what we found out was the Census Bureau created these tracts to do stuff like collect population information and they tried to do it in 200 to 600 living units or household areas, and it seemed like the natural thing to jump right into in creating a model based on publicly available information, because we don't have the records of all the telephone companies in the United States, and we don't have the way the embedded base is laid out in this part of geography. And as both Jim and Bob mentioned, we're trying to refine this down to determining where people actually live in clusters so that you can connect the dots, if you will, with cable, and we're getting closer and closer to the perfect map which I've been told is a scale of one to one.

MR. MERCER: Just for the record, so people can hear, we just jumped through several slides to one

EXHIBIT 2

A brief explanation of the Hatfield Model distribution algorithm is provided below.

As explained in Section III above, to determine the facilities needed to serve a CBG, the Hatfield Model represents each CBG as a square divided into four quadrants. The Model then adjusts the total CBG area by a certain percentage, called an "empty fraction," which is designed to represent the area of the CBG classified as empty. If this fraction does not exceed an arbitrarily set threshold of 50 percent, customers are assumed to occupy all four quadrants uniformly minus the "empty fraction."

To determine the appropriate size of customer clusters, the Model then calculates the average lot size occupied by each customer by dividing the number of "occupied" square miles by the number of customer locations in the CBG. If the calculated average lot is smaller than three acres, an arbitrarily set variable, the Model assumes distribution facilities are necessary to serve the entire area of each quadrant. If the calculated lot size is larger than three acres, then all customers are "clustered" in the center of each quadrant. The size of these "clusters" is calculated by multiplying the number of customers per quadrant by the three acre variable (representing the approximate area occupied by each customer).

If the empty fraction of the CBG does not exceed 50 percent and if the CBG does not fall into one of the lowest three density zones, the Model assumes that 85 percent of the customers are "clustered" in the centers of two diagonally-opposite quadrants. If the CBG is in one of the lowest three density zones, the Model estimates that 85 percent of the customers are clustered in the centers of all four quadrants. The